

MARYLAND
WEST NILE VIRUS SURVEILLANCE
ANNUAL FINAL REPORT
April 1, 2001

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INTRODUCTION

Using Center for Disease Control and Prevention (CDC) guidelines outlined in the November, 1999 document "*Epidemic/Epizootic West Nile Virus in the United States: Guidelines for Surveillance and Control*," the Maryland Department of Health and Mental Hygiene (DHMH), in collaboration with the Maryland Department of Agriculture (MDA) and the Maryland Department of Natural Resources (DNR), designed and implemented a multifaceted, interdepartmental surveillance plan for West Nile virus (WNV) detection and response activities. This response was initiated following the first laboratory confirmed appearance of WNV in the Western Hemisphere in 1999 (New York, New Jersey, Connecticut and Maryland) and the subsequent predicted geographic distribution of the disease. In 1999, Maryland's solitary WNV-positive finding was a dead crow found in downtown Baltimore in October.

The Maryland West Nile Virus Surveillance Plan, 2000 highlights four critical components of WNV surveillance: mosquito, avian, veterinary, and human. This final report describes the implementation of *Maryland's West Nile Virus Surveillance Plan, 2000* and highlights and interprets notable surveillance findings.

SUMMARY OF SURVEILLANCE INDICATORS

Mosquito Surveillance:

Using both CDC light traps and gravid traps to collect mosquitoes on a weekly basis, MDA sampled fourteen jurisdictions throughout Maryland during the surveillance period January 1 - December 31, 2000. Mosquitoes were trapped, sorted by genus and species into pools of 2-40 mosquitoes, then submitted to DHMH Laboratories Administration for WNV testing using real time, reverse transcriptase polymerase chain reaction (RT-PCR). Results were reported to the Center for Veterinary Public Health on a weekly basis. A total of 93,848 mosquitoes were submitted for WNV testing; **all mosquito samples were negative for WNV**. While initial collection efforts focused on *Culex sp.*, believed to be the primary vector responsible for transmission of WNV, CDC urged additional focus on *Aedes sp.* when mosquito samples from that genus were found to be WNV-positive in New York, New Jersey, Massachusetts, and Pennsylvania. A breakdown of mosquitoes tested according to genus is shown in Figure 1. Intensified mosquito surveillance ended November 1, 2000, although some limited sampling of known mosquito overwintering sites continued through the winter months.

Avian Surveillance:

Surveillance of avian populations, thought to be the best indicator of local WNV activity, can be further subdivided into two types: live bird surveillance and dead bird surveillance.

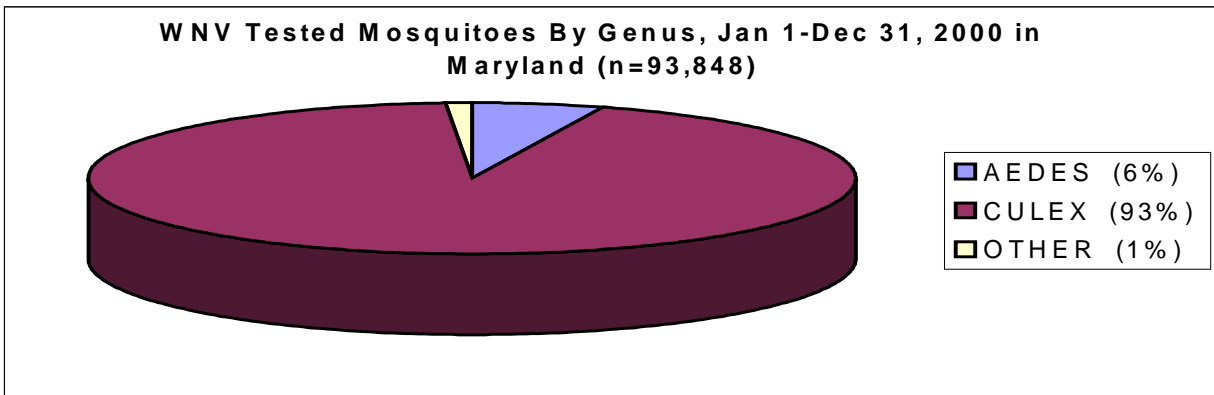


Figure 1

Live Bird Surveillance:

Chickens have historically been used as sentinels for other arboviruses such as Eastern Equine Encephalitis. Routine monitoring of caged birds' blood antibodies serves as a tool in the detection of epizootic transmission of arboviral disease, including WNV, in a given area. Fourteen sentinel chicken flocks consisting of four birds each (56 total birds) were established and maintained by MDA in ten jurisdictions for the period May 21 - September 28, 2000. Chicken sera specimens were collected bi-weekly by MDA field workers and transported to the DHMH Laboratories Administration for WNV antibody testing (ELISA). **All 559 chicken sera samples tested negative for WNV antibody.**

Another component of live bird surveillance was an ongoing wild and captive bird serosurvey, conducted by the DNR Fish and Wildlife Health Program. Field technicians speciated and bled wild and captive birds (including waterfowl, Canadian geese, pigeons, crows and raptors) captured at designated collection sites throughout Maryland. In 2000, a total of 265 wild bird blood samples were submitted to the National Wildlife Health Center in Wisconsin; **all wild and captive avian serosurvey samples were negative for viral isolation of WNV.** However, one crow specimen collected on September 29, 2000 did test antibody positive (virus isolation was negative) for WNV, indicating some unknown prior exposure to WNV and subsequent recovery.

Dead Bird Surveillance:

The Maryland West Nile Virus Reporting Hotline, a toll-free, 24-hour hotline staffed by personnel from both DNR and DHMH, was launched on May 19, 2000. In addition to providing information concerning national and statewide WNV epidemiology, mosquito control measures and referrals for human health concerns, the Maryland West Nile Virus Reporting Hotline served as a triage point for coordinating dead bird pick-up. A hotline staff, consisting of 2 - 6 state and local health department representatives, fielded citizen reports of dead or dying birds and contacted local health departments alerting them of potential appropriate specimens (freshly dead crows, raptors or blue jays without obvious cause of death). Local health departments selected birds (based on geographic location and freshness of specimen) and delivered them to DHMH Laboratories Administration for WNV testing by RT-PCR.

MD WNV REPORTING HOTLINE CALLS BY MMWR WEEK

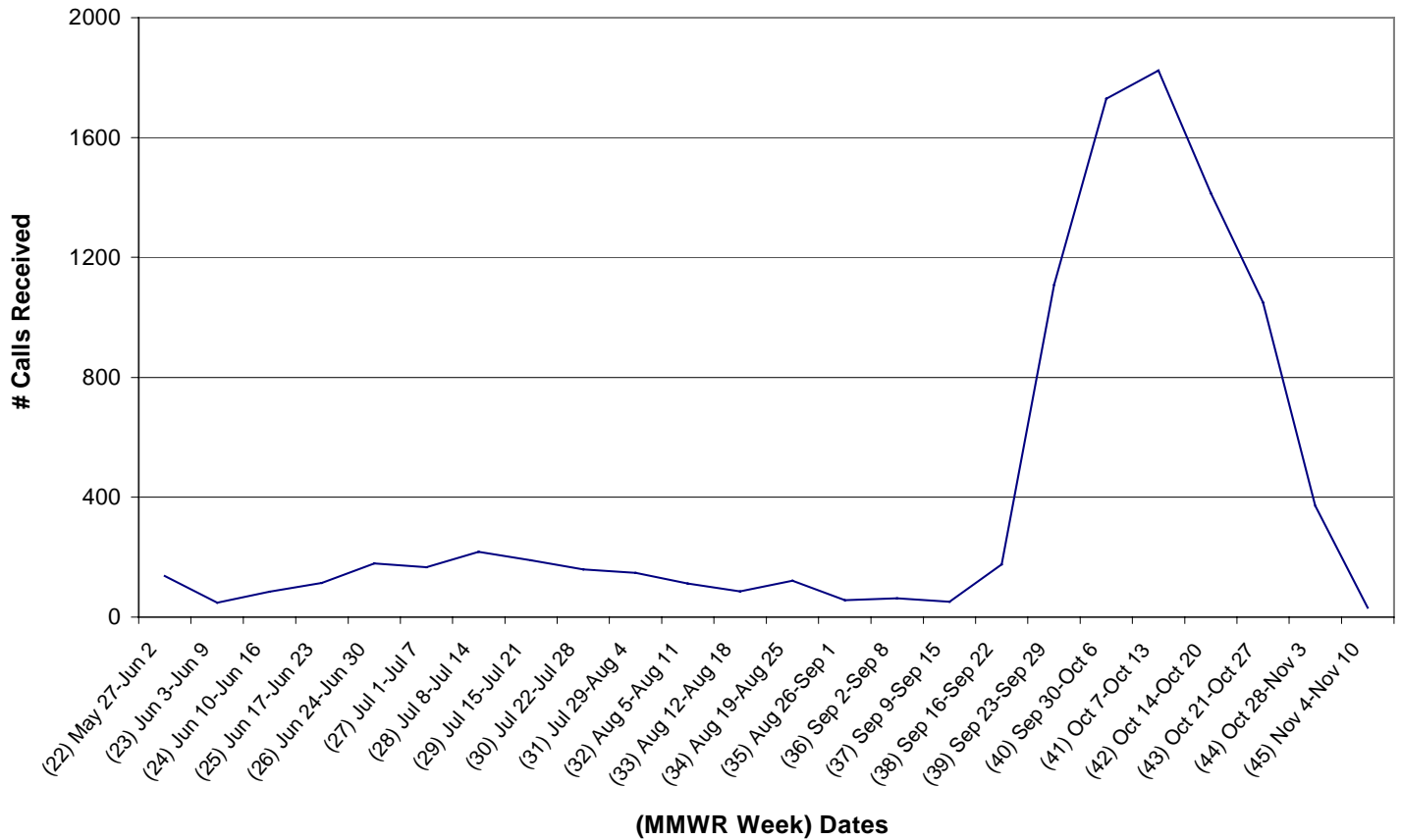


Figure 2.

The hotline received a total of 13,605 calls in calendar year 2000, with 66% of calls reporting dead/dying birds. Approximately 34% of calls received by the hotline were from citizens or health care providers seeking information only. The majority of calls ($\geq 8,900$) were concentrated within a seven-week period that began immediately after the year's first reported WNV positive finding on September 20, 2000 (Morbidity and Mortality Weekly Report (MMWR) Week 38, Figure 2).

Of the dead birds submitted from Maryland for WNV testing, 893 birds of 950 (94%) were tested for WNV during the 2000 surveillance season. The remaining 57 birds could not be tested due to poor condition of specimen upon receipt at the DHMH Laboratories Administration. **Fifty (50) birds submitted from Maryland tested positive for WNV** (48 crows, 2 blue jays). The positive birds were collected in a five week period, between September 13th and October 20th from eight jurisdictions; the majority from the Baltimore City area (Table 1, Figure 3).

Dead bird pickup by local health departments ceased October 31, 2000. The hotline remained operational until December 31, 2000, with regular staff available to process any dead/dying bird reports, forward calls to appropriate agencies, and to respond to public inquiries. Limited avian surveillance by MDA and DNR continued throughout the winter months.

Table 1. Avian submissions and WNV positive specimens by Maryland jurisdiction, Jan-Dec 2000

Jurisdiction*	No. Avian Submissions	No. Positive Avian Specimens	% Positive
Allegany Co.	3	0	0
Anne Arundel Co.	84	2	2.4
Baltimore City	142	29	20.4
Baltimore Co.	127	9	7.1
Calvert Co.	8	0	0
Caroline Co.	3	0	0
Carroll Co.	25	0	0
Cecil Co.	15	0	0
Charles Co.	15	2	13.3
Dorchester Co.	4	0	0
Frederick Co.	36	1	2.8
Garrett Co.	9	0	0
Harford Co.	37	0	0
Howard Co.	67	3	4.5
Kent Co.	7	0	0
Montgomery Co.	179	3	1.7
Prince George's Co.	85	1	1.2
Queen Anne's Co.	16	0	0
Somerset Co.	1	0	0
St. Mary's Co.	8	0	0
Talbot Co.	4	0	0
Washington Co.	3	0	0
Wicomico Co.	6	0	0
Worcester Co.	9	0	0
Total	893	50	5.6

***Positive jurisdictions bolded**

AVIAN WNV SUBMISSIONS BY JURISDICTIONS, JAN-DEC 2000

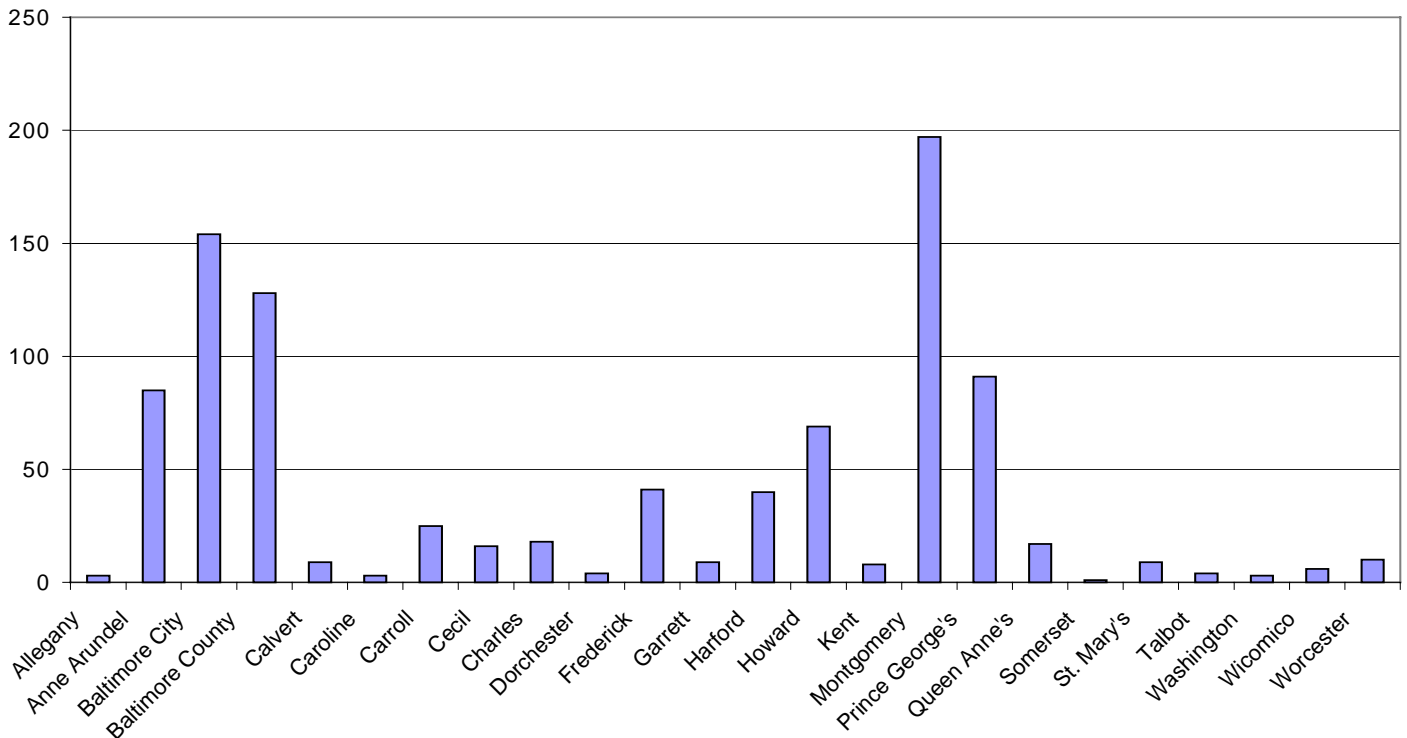


Figure 3.

Veterinary Surveillance:

On May 1, 2000, all veterinarians registered with the Maryland State Board of Veterinary Medical Examiners (~2500) were contacted by the Maryland State Public Health Veterinarian in a mass mailing alerting them to the clinical signs and symptoms of West Nile and other arboviral infections in horses (equines). Recommendations for equine specimen submission and laboratory testing were included, as well as the United States Department of Agriculture (USDA) West Nile Virus Fact Sheet. Ten (10) equine specimens were submitted during the WNV surveillance season for RT-PCR testing; **all veterinary samples were negative for WNV**. Testing of equine samples continued during winter months when requested. In addition to equine submissions, one pygmy goat and one deer also tested negative for WNV. Beginning in mid-September, randomly selected bats that were rabies negative (n=40) were subsequently submitted for WNV testing as well; **all bats tested negative for WNV**.

Human Surveillance:

On June 27, 2000, guidelines were issued to all local health departments concerning enhanced passive surveillance of human encephalitis and aseptic meningitis cases in order to confirm or rule out WNV as a cause. The Acting State Epidemiologist notified, by letter, infection control professionals, emergency department directors, neurologists, and infectious disease physicians in Maryland hospitals of the existence of the human arbovirus surveillance project. They were requested to report any suspected, probable, or confirmed encephalitis or meningitis cases to the appropriate local health departments.

Maryland DHMH Laboratories Administration offered serologic testing of human blood and cerebrospinal (CSF) specimens, and viral culturing of specimens meeting

specific collection and transportation criteria. Blood specimens were tested against an arboviral panel that included the agents of California encephalitis, Eastern Equine encephalitis, Western Equine encephalitis, St. Louis encephalitis and West Nile encephalitis. CSF specimens were tested for West Nile virus antibody only. Arboviral testing was prioritized for patients with encephalitis (all ages) or aseptic meningitis (age ≥ 17 years) that did not have laboratory evidence that confirmed a specific agent. Testing was not recommended for mildly symptomatic patients (fever and headache only). An effort was made to collect specimens on all appropriate encephalitis and aseptic meningitis cases with symptom onset of May 1 or later. In addition to WNV testing, health care providers were asked to complete a surveillance form detailing patient clinical, laboratory, risk factor, and vaccine history information. The enhanced surveillance for human WNV cases ended on November 30, 2000, although testing remains available at the State Laboratory year round if specifically requested.

There were 16 reported encephalitis cases during the 2000 WNV surveillance season (May 1-November 30). This number was nearly identical to the 1994-98 5-year average of 15 (Table 2). Of the 16 encephalitis cases reported during the 2000 arboviral surveillance season, 8 (50%) were tested for WNV antibody; all tested negative. Enhanced surveillance resulted in an increase of reported aseptic meningitis cases in 2000 over previous years: 382 cases were reported during the 2000 WNV surveillance season, compared to the 1994-98 5-year average of 212 (Table 2). Of the 382 aseptic meningitis cases, 102 (27%) were tested for WNV antibody; all 102 were negative, although 1 had evidence of a previous unspecified, flavivirus (a family of structurally similar viruses) infection.

In addition to the aseptic meningitis and encephalitis cases, specimens were submitted for WNV testing for 86 cases with “other” clinical conditions. Of these non-encephalitis/non-meningitis cases, all 86 individuals tested negative for WNV antibody, although 5 showed evidence of previous unspecified flavivirus infection. Seven (7) patients who were originally reported, but later ruled out, as encephalitis or meningitis cases tested negative for WNV antibody as well.

In summary, 203 humans were tested for WNV infection between May 1 and November 30, 2000. All 203 tested negative for WNV antibody, although 6 had evidence of previous unspecified flavivirus infection (although no current infection) (Table 3). **No Maryland residents tested positive for WNV antibody during the 2000 season.**

Table 2. Maryland Reported Cases of Confirmed, Probable or Suspect Encephalitis and Aseptic Meningitis May 1-Nov 30 by Year

	2000	1998	1997	1996	1995	1994	1994-98 Average
Encephalitis	16	7	8	17	20	25	15
Aseptic Meningitis	382	231	255	154	257	165	212

Table 3. Test Results by Disease for Humans Tested for WNV Antibody May 1-Nov 30, 2000

	Negative	Positive	Pending	Total
Encephalitis	8	0	0	8
Aseptic Meningitis	*102	0	0	102
Ruled out Encephalitis/Meningitis	7	0	0	7
Other	**86	0	0	86
Total	203	0	0	203

*One person showed evidence of unspecified previous flavivirus infection.

**Five people showed evidence of unspecified previous flavivirus infection.

MOSQUITO CONTROL

MDA implemented an aggressive mosquito control program using ground spraying of the adulticide Permethrin (10% permethrin, 6% piperonyl butoxide, 84% mineral oil) in areas with any WNV positive findings consistent with CDC recommendations set forth in the July 21, 2000 MMWR article entitled “*West Nile Virus Activity – New York and New Jersey, 2000.*” Following consultations with the CDC, spraying areas surrounding a WNV positive finding were modified from a two-mile radius, advised in the MMWR article, to two square miles. This modification was due to Maryland’s late season viral activity and cooler temperatures, which decrease viral amplification and limit mosquito flight range. Truck-mounted, low-volume sprayers distributed 2/3 fluid ounce per acre of the pesticide product. Two Baltimore City neighborhoods could not be sprayed due to inadequate climatic conditions. In addition to adulticiding efforts, routine mosquito larviciding occurred in spring, 2000, and will be repeated this spring.

Prior to any mosquito reduction treatment in an area with a WNV positive specimen, town meetings were announced by door-to-door distribution of flyers and via the media (print, radio, and television). These meetings were held in central locations to discuss spray routes and methods of adulticide treatment, the human health effects of pesticide exposure, and mosquito risk reduction techniques. Community input from citizens living in proposed mosquito control areas determined if adulticiding would occur. Representatives from MDA, DHMH and local health departments were on hand to answer questions and address concerns of community members and various interest groups prior to finalizing adulticide plans and spray schedules. In addition, MDA maintained a toll-free information telephone line with a pre-recorded message concerning proposed spray areas and spray schedules.

PESTICIDE TOXICITY SURVEILLANCE

Surveillance of acute pesticide-related toxicity in humans was conducted by DHMH at four Baltimore City sentinel hospitals for five days immediately following mosquito adulticiding (mosquito control measures targeting adult mosquito populations) and five Montgomery County hospitals for three days immediately following mosquito

adulticiding. **Each of nine sentinel hospital emergency departments (EDs) reported that no people presented to their EDs with symptoms the patient attributed to pesticide spraying.** The Maryland Poison Control Center (Baltimore) and the National Capital Area Poison Control Center (DC) also collected data from WNV related calls over a 30-day period. The poison control centers reported a total of 208 calls related to WNV activity and/or subsequent spraying. Ten callers (5%) reported symptoms they attributed to spraying: 7 reported asthma exacerbation, 2 reported paresthesias, and 1 reported rash. Five (5) individuals had symptoms that had resolved by the time they contacted the poison control center; the remaining five callers were referred to their primary care provider or ED. **No callers were hospitalized.**

PUBLIC INFORMATION CAMPAIGN

In addition to WNV surveillance activities, DHMH implemented a multi-tiered health education and risk reduction campaign.

A variety of media outlets (including local television and radio stations, as well as newspaper interviews) were instrumental in communicating public health messages to Maryland citizens throughout the WNV season. Media relations specialists from the Governor's Office, DNR, DHMH, and MDA coordinated a unified health education message focusing on personal protective measures, community responsibility, and source reduction of mosquito breeding grounds. At the launch of the 2000 surveillance season, Governor Parris N. Glendening held a press conference to inform Maryland residents of the health risks that mosquitoes pose to humans, and challenged citizens to reduce mosquito breeding grounds in their backyards and communities. Additionally, MDA maintained a toll-free, pre-recorded telephone message with upcoming spray schedules, coordinated town meetings, and published and distributed a pamphlet entitled "*SWARM: Standing Water Attracts Risky Mosquitoes*" that highlighted mosquito reduction techniques.

One-on-one health education was an integral part of Maryland's West Nile Virus Reporting Hotline. Using CDC Fact Sheets on WNV, staffers answered individual concerns with accuracy and compassion. Callers were routinely referred to their local health departments or primary care providers for any medical or human health concerns, and were given the opportunity to call the Center for Veterinary Public Health if they still had additional questions.

Finally, DHMH maintained a comprehensive web page dedicated to WNV and its activity in Maryland. Information available on the DHMH website included a WNV fact sheet, weekly updated surveillance testing results, pesticide spray schedule, permethrin fact sheet, related press releases, and links to other relevant agency web pages.

2000 EVALUATION AND 2001 RECOMMENDATIONS

The following discussion highlights implementation of the *Maryland West Nile Virus Response Plan, 2000* and contains preliminary recommendations from the National CDC WNV Planning Meeting held January 31 - February 4, 2001.

Mosquito Surveillance:

Mosquito surveillance occurred in 14 Maryland jurisdictions in 2000. While identification of WNV positive mosquito pools indicates the probability of epizootic

(local) transmission, mosquitoes are not recognized as being a highly sensitive indicator of viral activity, especially when compared to dead bird surveillance. In fact, CDC has likened mosquito surveillance to "looking for a needle in a haystack." Nonetheless an important surveillance indicator, expansion of mosquito surveillance throughout Maryland is recommended. Improved sampling of *Aedes* species is recommended in light of the positive *Aedes albopictus*, an urban opportunistic daytime feeder.

Avian Surveillance:

Live Bird Surveillance:

While sentinel chicken flocks were set up in several states, the CDC reported that by November 2000, only 6 chickens had sero-converted to being WNV antibody positive, indicating that they had recently been infected by WNV infected mosquitoes in the area. However, these sero-conversions *did not occur prior to human infections in the same area*. Given the relative failure of chickens to act as sentinels to predict the risk of human disease, it is unlikely that the labor-intensive establishment, maintenance and surveillance of chicken flocks for WNV activity will be utilized in 2001. DNR is currently considering different sentinel species and will continue its wild bird sero-survey.

Dead Bird Surveillance:

Providing 24-hour coverage at the DNR/DHMH WNV Reporting Hotline was extremely problematic. Although two staff members were originally funded and hired to provide coverage 70 hours per week, the sudden influx of calls following the announcement of the initial positive bird forced the recruitment of DHMH and DNR employees and local health department personnel to provide adequate hotline coverage. Additional hotline support was funded by a combination of Emerging Infections Program (EIP) grant award and redirected general funds. DHMH is currently contacting hotline call centers to assess their capacity in providing coverage for citizen inquiries and dead bird reports during the 2001 WNV surveillance season. Unlike the 2000 dead bird reporting hotline, a call center will be equipped to handle fluctuating call volume throughout the year while retaining the advantages of a central triage point: uniformity of messages to public, greater supervision and more accurate data collection. One-on-one health education was also noted as being effective in 2000 based on citizens' feedback and will continue in the future.

Veterinary Surveillance:

Veterinary surveillance will continue to be an integral component of Maryland's West Nile Virus Response Plan. Continued contact with veterinarians in Maryland counties and neighboring states with known WNV positive equine or mosquito findings should be established and maintained throughout the surveillance period. This will be particularly important in light of Delaware's four WNV positive equines in 2000.

Human Surveillance:

Slightly less than half (42%) of the humans tested in 2000 had neither encephalitis nor aseptic meningitis, despite the fact that these disease categories were the targeted testing groups. In the future, increased emphasis will be given to local health departments, infection control practitioners, and emergency department directors

addressing which patients should receive testing priority. No follow-up will be required for non-encephalitis/non-meningitis cases unless a preliminary WNV positive result is obtained.

Local health departments and hospital infection control practitioners were notified of the enhanced surveillance at different times in 2000; this may have affected the coordination of serum collection and surveillance form completion. Although infection control practitioners were notified about WNV testing in April, local health departments were not sent current case investigation guidelines until late June. Although guidelines were not distributed until late June, follow-up and testing was requested for all encephalitis and aseptic meningitis cases with symptom onset of May 1st. Advising local health departments and infection control practitioners of surveillance plans prior to the beginning of the 2001 WNV surveillance season should improve coordination of surveillance and specimen collection efforts.

Another problem encountered during the 2000 WNV surveillance season was the lack of convalescent serum specimens. The CDC defined a non-case as an individual who had a negative specimen collected >8 days post onset of symptoms. Of the 203 humans tested in 2000, only 44 (22%) had specimens collected >8 days post onset; these individuals were definitely ruled out as having WNV infection. Increased effort is needed in the future regarding the collection of convalescent serum specimens.

Mosquito Control:

Community health education regarding mosquito source reduction (identification and elimination of standing water) was identified as an integral part of WNV risk reduction. Aggressive mosquito reduction methods (larvaciding and adulticiding) for the prevention of WNV may have played a role in decreasing the number of persons exposed to WNV. Maryland mosquito control efforts for the prevention of WNV human infections will continue to be based on CDC published recommendations and state-specific consultations.

Pesticide Toxicity Surveillance:

General public and environmental activists' concerns about pesticide poisoning necessitated the pesticide toxicity surveillance component of the Maryland WNV Response Plan. Pending additional funding, an epidemiologist will be assigned to continue monitoring the effects of pesticide toxicity as it relates to mosquito control for WNV.

Public Information Campaign:

In addition to continued use of media outlets, a hotline center and coordinated town meetings, there are current plans to develop more written educational materials aimed at the general public addressing human health concerns and risk reduction activities. DHMH will also work to keep the WNV web page updated on a more frequent basis, with more extensive information, including area maps and national surveillance findings.

SUMMARY

There is no evidence of local epizootic transmission in Maryland at this time. The only positive WNV findings in 2000 were 50 avian specimens discovered within a 5-

week period between September 13th and October 20th. The absence of positive mosquitoes, equines or humans, as well as the short time period and location in which all positive birds were detected suggests the possibility of migrating birds being responsible for the positive findings.

One Baltimore City WNV positive bird was identified in Maryland in 1999. In 2000, Maryland experienced a dramatic increase in WNV positive findings. Given the continued geographic dispersion of WNV from the original New York epicenter (as far north as New Hampshire and as far south as North Carolina), Maryland must continue to be vigilant in its control and surveillance efforts. Prevention efforts, perhaps also responsible for the lowered risk to human health this year, must also continue to be stressed. Implementation of the *Maryland West Nile Virus Surveillance Plan, 2000*, by state agency coordinated WNV Interagency Working Group members, resulted in multiple surveillance efforts and detection of the virus more than three weeks earlier than 1999. Factors critical to the success of the task force included clear delegation of responsibility based on agency scope and mission, open communication and timely completion of assigned tasks.